

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

## Exhibit "A"

In the specification, page 8, lines 5, 6 and 8 on page 9, amend the paragraph to now read:

Referring specifically to Figure 1A and 1B of the drawings, schematic flow diagrams 2 and 2' are disclosed, these diagrams each schematically including several sections arranged successively and substantially in-line to produce the unified novel carded filter media 3 and 3' such as disclosed in Figures 2 and 3 respectively of the drawings. The disclosed flow-diagrams, each broadly includes four sections – namely, the mixer-blender sections 4 and 4', the carding sections 6 and 6', the heating sections 7 and 7' and the calendaring sections 8 and 8'. Mixer-blender section 4, as shown in Figure 1A, discloses three spaced mixer-blenders 9, 11 and 12. These mixer-blenders 9, 11 and 12 can be arranged with the outlets at different spaced levels to feed well blended chopped fibers of selected sizes to endless collector belts 13, 14 and 16, respectively spaced at different selected levels to cooperate respectfully with the outlets of mixer-blenders 9, 11 and 12. Spaced belts 17, 18 and 19 of selected thickness layers of well blended chopped fiber filter media mats are formed respectively on endless collector belts 13, 14 and 16 and are passed to the carding section 6. In a manner generally known in the art and not shown herein, chopped fibers measuring approximately one half (1/2) inches to one and two (2) inches in length of selected coarse to fine deniers, as determined in accordance with the present invention described hereinafter are passed to mixer-blenders 9, 11, and 12, respectively, from hopper feeders, beater openers, conveyor fans, fine openers and vibra feeders. In accordance with the present invention and based on environmental conditions the fibers fed to mixer-blenders 9, 11 and 12 can be of several combinations of coarse fibers, intermediate fibers and fine fiber layers. For example, when two layers of media are involved combinations of either coarse fibers and intermediate or fine fibers or even intermediate and fine fibers can be

employed. When three layers of media are involved combinations of coarse fibers intermediate fibers, and fine fibers can be employed. A "coarse media" layer of selected thickness with all fibers measuring approximately between one half to two ( $1/2 - 2$ ) inches in fiber length advantageously is considered to be of approximately thirty (30) percent fifteen (15) denier fibers, of approximately thirty (30) percent six (6) denier fibers and of approximately forty (40) percent of six (6) denier low melt fibers. An "intermediate media" layer with all fibers measuring approximately between one-half to two ( $1/2 - 2$ ) inches in fiber length advantageously is considered to be of approximately forty (40) percent six (6) denier fibers, of ten (10) percent three (3) denier fibers and fifty (50) percent four (4) denier low melt fibers. A "fine media" layer with all fibers measuring approximately between one half to two ( $1/2 - 2$ ) inches in fiber length advantageously is considered to be of approximately forty (40) percent three (3) denier fibers, ten (10) percent one (1) denier fibers and fifty (50) percent four (4) denier low melt fibers. In the carding section 6 of Figure 1A, three spaced carding roll assemblies 21, 22 and 23 are shown. Each assembly includes a spaced main carding roll 24, 26, and 27, respectively, with each having a cooperating smaller semi-random carding roll 28, 29 and 31, respectively. Suitable guide roll sets 32, 33 and 34, respectively, are provided with each carding roll assembly 21 and 21', 22 and 23 respectfully to insure that the spaced carded fibrous filter media belts are properly passed in spaced alignment to heating section 7 and through the spaced open-ended heating oven 37 and 37' and spaced calendaring section 8 which includes the cooperating spaced upper and lower calendaring rolls 38 and 38'.

Claim 1, amend to read as follows:

C2  
1.) A multi-thickness filter media comprising a combination of at least two successive adjacent face-to-face thicknesses of selected filter fiber sizes with each thickness having fiber sizes so that the pore size characteristics of one thickness differs from that of an adjacent thickness with said fibers of one thickness being comparatively finer than said fibers of said other thickness and with the fiber sizes and pore sizes of said successive adjacent face-to-face thicknesses of fibers being calculated including factors of thicknesses and relative pore sizes of each layer to take in to account the differences in thickness, porosity, pore and fiber sizes between layers with said porosity in such an arrangement comprising the ratio of pore volume to the total volume of filter media so that the overall average pore size of the combined successive thicknesses is smaller than that of the average overall pore size of that of the finest fiber thickness, so as to optimize filtration performance efficiency.

Claim 18, amend to read as follows:

C3  
18.) A multi-thickness filter media comprising at least three different fiber sizes in successive horizontally extending adjacent face-to-face independent thicknesses of carded, chopped fibers, said carded, chopped fibers of each independent thickness having a combination of fibers and pore size characteristics with the carded, chopped fibers of each independent thickness being substantially opened and aligned, the fiber size characteristics from downstream toward upstream thicknesses being approximately one to four (1-4), six (6) and at least twenty (20) deniers from downstream finer denier thickness toward said upstream coarser thicknesses, with pore sizes increasing from the finer downstream lower denier thickness toward the coarser upstream higher denier thickness; said adjacent face-to-face thicknesses being bonded by a

selected acrylic binder, the carded fibers in said thicknesses being calculated including factors of thicknesses, porosity, pore and fiber sizes of each layer to take in to account the differences in thickness pore and fiber sizes between layers with said porosity in such an arrangement comprising the ratio of pore volume to the total volume of filter media so that the overall average pore size of that of adjacent successive thicknesses is smaller than that of the average overall pore size of said independent finest fiber thickness calculated by the formulas expressed:

$$\frac{1}{M} = \varepsilon_1 \varepsilon_{i+1} \dots \varepsilon_n \left( \sum_{i=1}^n \frac{1}{M_i} \right)$$

wherein the porosity "ε" is the ratio of the pore volume to the total volume of medium, "Σ" is the summation from "i" = 1 to n, and "M" is the mean flow pore diameter of the filter media thicknesses and with the air frazier permeability of said three thicknesses filter medium being expressed by the formula:

$$\frac{1}{V} = \varepsilon_1 \varepsilon_{i+1} \dots \varepsilon_n \left( \sum_{i=1}^n \frac{1}{V_i} \right) \dots \dots \dots 6$$

wherein "V" is air frazier, fluid velocity, in cfm/square foot, the porosity, "ε" is the ratio of the pore volume to the total volume of media; and "Σ" is the summation from "i" = 1 to n.

Claim 19, amend to read as follows:

19.) A method of manufacturing filter media comprising: collecting a first independent measured thickness weight of chopped fibers in a mixer-blender zone, said first independent measured thickness weight of chopped fibers being of selected denier and pore size;

CH  
collecting at least a second independent measured thickness weight of chopped fibers in a mixer-blender zone to be successively joined in overlying face-to-face thicknesses relation with said first measured thickness weight of chopped fibers, said second measured thickness weight of chopped fibers being of selected denier and pore size different from said denier and pore sizes of said first measured thickness weight of chopped fibers with said fibers of one independent thickness being finer than said fibers of said other independent thicknesses; passing said first and second measured thickness weights to a carding zone to open and align said chopped fibers in each said successively joined filter media thicknesses having face-to-face relationship to maximize particulate dirt holding capacity and to increase efficiency with the thicknesses being calculated with an arrangement including factors of thicknesses, pore and fiber sizes of each layer to take in to account the differences in thickness, porosity, pore and fiber sizes between layers with said porosity in such an arrangement comprising the ratio of pore volume to the total volume of filter media so that the overall average pore size of that of successive face-to-face thicknesses is smaller than that of the average overall pore size of the independent finest fiber thicknesses.

Claim 27, amend to read as follows:

CB  
27.) A method of manufacturing multi-layered filter media comprising: collecting in a mixer-blender zone at least a first and second layer of chopped fibers in separate independent thickness layers, each layer of filter media being of measured weight with at least one layer being of low melt fibers with said fibers of one independent layer being finer than said fibers of said other independent layer fibers; passing each layer through a carding zone including separate successive carding zone sections for each to open and align the fibers of each layer and to

position the first and second layers in adjacent face-to-face relation; passing said adjacent face-to-face layers to a heating zone of sufficient heat to melt bind said layers in fast rotation, said corded fibers in said bonded layers being calculated including factors of thickness, pore and fiber sizes of each layer to take in to account the differences in thickness, porosity, pore and fiber sizes between layers with said porosity in such an arrangement comprising the ratio of pore volume to the total volume of filter media so that the overall average pore size of the majority of pores of combined adjacent successive layers is smaller than that of the average overall pore size of the majority of pores of said independent finest fiber thickness layer calculated by formulas expressed:

$$\frac{1}{M} = c_1 c_2 \dots c_n \left( \frac{1}{M_1} \right)$$

$$\frac{1}{V} = c_1 c_2 \dots c_n \left( \frac{1}{V_1} \right) \dots \dots \dots 6$$

with the porosity "c" is the ratio of pore volume to the total volume of medium, "n" is the summation from "1" = 1 to n, and "M" is the mean flow pore diameter of the filter media layers and "V" is fluid velocity in cubic foot per minute over square feet (cfm/sq. ft.).

Claim 28, add to read as follows:

28.) A method of calculating filter media including at least two successive adjacent upstream-downstream upstream and downstream layers of filter media so as to estimate differences

to-face filter media so that the fiber and pore size characteristics of one layer differs from the fiber and pore size characteristics of the other layer with the fibers of said downstream layer being finer than said upstream layer, said selected and facing upstream and downstream layers being calculated in a formula taking into account the differences in said upstream and downstream layers and the factor differences of thickness, pore and fiber sizes and the porosity comprised of the ratio of pore volume to the total volume of filter media so that the overall average pore size of the combined successive upstream and downstream layers of filter media is smaller than that of the overall pore size of that finest fiber downstream layer.

Claim 29, add to read as follows:

29.) The method of Claim 28, wherein said fibers of each layer are corded, chopped, and substantially opened and aligned.

Claim 30, add to read as follows:

30.) The method of Claim 28, wherein the selected fiber characteristics of one filter media layer is less than size (6) denier and the other is at least six (6) denier.

Claim 31, add to read as follows:

31.) The method of Claim 28, wherein there are at least three (3) different denier fibers with the denier characteristics of each being approximately one to four (1-4), six (6) and at least twenty (20) respectively.

Claim 32, add to read as follows:

10

11

32.) The method of Claim 28, wherein said combined layers of filter media are

Claim 33, add to read as follows:

33.) The method of Claim 32, wherein said combined layers of filter media are

Claim 34, add to read as follows:

34.) The method of Claim 34, said filter media of Claim 34, said fibers having low melt characteristics with said

Claim 35, add to read as follows:

35.) The method of Claim 35, said face-to-face layers of filter media including layer

Claim 36, add to read as follows:

36.) The method of Claim 36, said face-to-face layers of filter media including layer

Claim 37, add to read as follows:

37.) The method of Claim 37, wherein said layers being of separate face-to-face

Claim 38, add to read as follows:

38.) The method of Claim 38, wherein said layers being of separate face-to-face

Claim 39, add to read as follows:

39.) The method of Claim 39, wherein said layers being of separate face-to-face

Claim 40, add to read as follows:

40.) The method of Claim 40, wherein said layers being of separate face-to-face

Claim 38, add to read as follows:

38.) The method of Claim 28, wherein said successive layers extend horizontally, with the upstream thickness layer of said combined successive thicknesses layers being of higher porosity and higher denier characteristics than a downstream thickness layer.

Claim 39, add to read as follows:

39.) The method of Claim 28, wherein the average pore size of said layered filter media is expressed by the formula:

$$\frac{1}{M} = \epsilon_i \epsilon_{i+1} \dots \epsilon_n \left( \sum_{i=1}^n \frac{1}{M_i} \right)$$

wherein the porosity "e" is the ratio of the pore volume to the total volume of medium, "Σ" is the summation from "i" = 1 to n, and "M" is the mean flow pore diameter of the filter media layers.

Claim 40, add to read as follows:

40.) The method of Claim 28, wherein the air frazier permeability of layered media is expressed by the formula:

$$\frac{1}{v} = \epsilon_i \epsilon_{i+1} \dots \epsilon_n \left( \sum_{i=1}^n \frac{1}{v_i} \right) \dots 6$$

wherein "v" is air frazier, fluid velocity, in cfm/square foot, the porosity, "e" is the ratio of pore volume to the total volume of medium; and "Σ" is the summation from "i" = 1 to n.

Claim 41, add to read as follows:



41.) The method of Claim 28, wherein said layered thicknesses comprise a coarse layered thickness and an intermediate layered thickness of fibers all of approximately one to two (1-2) inches in length with the coarse layer thickness advantageously approximately comprised of thirty (30) percent fifteen (15) denier fibers, thirty (30) percent six (6) denier fibers and forty (40) percent six (6) denier low melt fibers and the intermediate layer thickness advantageously comprised approximately of forty (40) percent six (6) denier fibers, ten (10) percent three (3) denier fibers and fifty (50) percent four (4) denier low melt fibers.

Claim 42, add to read as follows:

42.) The method of Claim 28, wherein said layer thicknesses comprise a coarse layer thickness and a fine layer thickness of fibers all of approximately one half to two (1/2 - 2) inches in length with the coarse layer thickness advantageously comprised approximately of thirty (30) percent fifteen (15) denier fibers, thirty (30) percent six (6) denier fibers and forty (40) percent six (6) denier low melt fibers and the fine layer thickness advantageously comprised approximately of forty (40) percent three (3) denier fibers, ten (10) percent one (1) denier fibers and fifty (50) percent two (2) denier low melt fibers.

Claim 43, add to read as follows:

43.) The method of Claim 28, wherein said layer thicknesses comprise a coarse layer thickness, an intermediate layer thickness and a fine layer thickness all of approximately one half to two (1/2 - 2) inches in length with the coarse layer thickness advantageously approximately comprised thirty (30) percent fifteen (15) denier fibers, thirty (30) percent six (6) denier fibers and forty (40) percent six (6) denier low melt fibers; the intermediate layer thickness

advantageously comprised of approximately forty (40) percent six (6) denier fibers, ten (10) percent three (3) denier fibers and fifty (50) percent four (4) denier low melt fibers; and, the fine layer thickness advantageously comprised approximately of forty (40) percent three (3) denier fibers, ten (10) percent one (1) denier fibers and fifty (50) percent two (2) denier low melt fibers.

Claim 44, add to read as follows:

44.) The method of Claim 28, wherein said layer thicknesses comprise an intermediate layer thickness and a fine layer thickness of fibers all of approximately one half to two (1/2 - 2) inches in length with the intermediate layer thickness advantageously comprised of approximately forty (40) percent six (6) denier fibers, ten (10) percent three (3) denier fibers and fifty (50) percent four (4) denier low melt fibers; and, the fine layer thickness advantageously comprised approximately of forty (40) percent three (3) denier fibers, ten (10) percent one (1) denier fibers and fifty (50) percent four (4) denier low melt fibers.

#### Exhibit "B"

In the specification, page 8, lines 5, 6 and 8 on page 9, amend the paragraph to now read:

Referring specifically to Figure 1A and 1B of the drawings, schematic flow diagrams 2 and 2' are disclosed, these diagrams each schematically including several sections arranged successively and substantially in-line to produce the unified novel carded filter media 3 and 3' such as disclosed in Figures 2 and 3 respectively of the drawings. The disclosed flow-diagrams each broadly includes four sections - namely, the mixer-blender sections 4 and 4', the carding sections 6 and 6', the heating sections 7 and 7' and the calendaring sections 8 and 8'. Mixer-blender section 4, as shown in Figure 1A, discloses three spaced mixer-blenders 9, 11 and 12. These mixer-blenders 9, 11 and 12 can be arranged with the outlets at different spaced levels to feed well blended chopped fibers of selected sizes to endless collector belts 13, 14 and 15, respectively spaced at different selected levels to cooperate respectfully with the outlets of mixer-blenders 9, 11 and 12. Spaced belts 17, 18 and 19 of selected thickness layers of well blended chopped fiber filter media mats are formed respectively on endless collector belts 13, 14 and 16 and are passed to the carding section 6. In a manner generally known in the art and not shown herein, chopped fibers measuring approximately one half (1/2) inches to one and two (2) inches in length of selected coarse to fine deniers, as determined in accordance with the present invention described hereinafter are passed to mixer-blenders 9, 11, and 12, respectively, from hopper feeders, beater openers, conveyor fans, fine openers and vibra feeders. In accordance with the present invention and based on environmental conditions the fibers fed to mixer-blenders 9, 11 and 12 can be of several combinations of coarse fibers, intermediate fibers and fine fiber layers. For example, when two layers of media are involved combinations of either coarse fibers and intermediate or fine fibers or even intermediate and fine fibers can be

employed. When three layers of media are involved combinations of coarse fibers intermediate fibers, and fine fibers can be employed. A "coarse media" layer of selected thickness with all fibers measuring approximately between one half to two ( $1/2 - 2$ ) inches in fiber length advantageously is considered to be of approximately thirty (30) percent fifteen (15) denier fibers, of approximately thirty (30) percent six (6) denier fibers and of approximately forty (40) percent of six (6) denier low melt fibers. An "intermediate media" layer with all fibers measuring approximately between one-half to two ( $1/2 - 2$ ) inches in fiber length advantageously is considered to be of approximately forty (40) percent six (6) denier fibers, of ten (10) percent three (3) denier fibers and fifty (50) percent four (4) denier low melt fibers. A "fine media" layer with all fibers measuring approximately between one half to two ( $1/2 - 2$ ) inches in fiber length advantageously is considered to be of approximately forty (40) percent three (3) denier fibers, ten (10) percent one (1) denier fibers and fifty (50) percent four (4) denier low melt fibers. In the carding section 6 of Figure 1A, three spaced carding roll assemblies 21, 22 and 23 are shown. Each assembly includes a spaced main carding roll 24, 26, and 27, respectively, with each having a cooperating smaller semi-random carding roll 28, 29 and 31, respectively. Suitable guide roll sets 32, 33 and 34, respectively, are provided with each carding roll assembly 21 and 21', 22 and 23 respectfully to insure that the spaced carded fibrous filter media belts are properly passed in spaced alignment to heating section 7 and through the spaced open-ended heating oven 37 and 37' and spaced calendaring section 8 which includes the cooperating spaced upper and lower calendaring rolls 38 and 38'.

Claim 1, amend to read as follows:

1.) A multi-thickness filter media comprising a combination of at least two successive adjacent face-to-face thicknesses of selected filter fiber sizes with each thickness having fiber sizes so that the pore size characteristics of one thickness differs from that of an adjacent thickness with said fibers of one thickness being comparatively finer than said fibers of said other thickness and with the fiber sizes and pore sizes of said successive adjacent face-to-face thicknesses of fibers being calculated including factors of thicknesses and relative pore sizes of each layer to take in to account the differences in thickness, porosity, pore and fiber sizes between layers with said porosity in such an arrangement comprising the ratio of pore volume to the total volume of filter media so that the overall average pore size of the combined successive thicknesses is smaller than that of the average overall pore size of that of the finest fiber thickness, so as to optimize filtration performance efficiency.

Claim 18, amend to read as follows:

18.) A multi-thickness filter media comprising at least three different fiber sizes in successive horizontally extending adjacent face-to-face independent thicknesses of carded, chopped fibers, said carded, chopped fibers of each independent thickness having a combination of fibers and pore size characteristics with the carded, chopped fibers of each independent thickness being substantially opened and aligned, the fiber size characteristics from downstream toward upstream thicknesses being approximately one to four (1-4), six (6) and at least twenty (20) deniers from downstream finer denier thickness toward said upstream coarser thicknesses, with pore sizes increasing from the finer downstream lower denier thickness toward the coarser upstream higher denier thickness; said adjacent face-to-face thicknesses being bonded by a

selected acrylic binder, the carded fibers in said thicknesses being calculated including factors of thicknesses, porosity, pore and fiber sizes of each layer to take in to account the differences in thickness pore and fiber sizes between layers with said porosity in such an arrangement comprising the ratio of pore volume to the total volume of filter media so that the overall average pore size of that of adjacent successive thicknesses is smaller than that of the average overall pore size of said independent finest fiber thickness calculated by the formulas expressed:

$$\frac{1}{M} = e_i e_{i+1} \dots e_n \left( \sum_{i=1}^n \frac{1}{M_i} \right)$$

wherein the porosity "e" is the ratio of the pore volume to the total volume of medium, "Σ" is the summation from "i" = 1 to n, and "M" is the mean flow pore diameter of the filter media thicknesses and with the air frazier permeability of said three thicknesses filter medium being expressed by the formula:

$$\frac{1}{v} = e_i e_{i+1} \dots e_n \left( \sum_{i=1}^n \frac{1}{v_i} \right) \dots \dots \dots 6$$

wherein "v" is air frazier, fluid velocity, in cfm/square foot, the porosity, "e" is the ratio of the pore volume to the total volume of [medium] media; and "Σ" is the summation from "i" = 1 to n.

Claim 19, amend to read as follows:

19.) A method of manufacturing filter media comprising: collecting a first independent measured thickness weight of chopped fibers in a mixer-blender zone, said first independent measured thickness weight of chopped fibers being of selected denier and pore size;

collecting at least a second independent measured thickness weight of chopped fibers in a mixer-blender zone to be successively joined in overlying face-to-face thicknesses relation with said first measured thickness weight of chopped fibers, said second measured thickness weight of chopped fibers being of selected denier and pore size different from said denier and pore sizes of said first measured thickness weight of chopped fibers with said fibers of one independent thickness being finer than said fibers of said other independent thicknesses; passing said first and second measured thickness weights to a carding zone to open and align said chopped fibers in each said successively joined filter media thicknesses having face to face relationship to maximize particulate dirt holding capacity and to increase efficiency with the thicknesses being calculated with an arrangement including factors of thicknesses, pore and fiber sizes of each layer to take in to account the differences in thickness, porosity, pore and fiber sizes between layers with said porosity in such an arrangement comprising the ratio of pore volume to the total volume of filter media so that the overall average pore size of that of successive face-to-face thicknesses is smaller than that of the average overall pore size of the independent finest fiber thickness.

Claim 27, amend to read as follows:

27.) A method of manufacturing multi-layered filter media comprising: collecting in a mixer-blender zone at least a first and second layer of chopped fibers in separate independent thickness layers, each layer of filter media being of measured weight with at least one layer being of low melt fibers with said fibers of one independent layer being finer than said fibers of said other independent layer fibers; passing each layer through a carding zone including separate successive carding zone sections for each to open and align the fibers of each layer and to

position the first and second layers in adjacent face-to-face relation; passing said adjacent face-to-face layers to a heating zone of sufficient heat to melt bind said layers in fast relation, said carded fibers in said bonded layers being calculated including factors of thicknesses, pore and fiber sizes of each layer to take in to account the differences in thickness, porosity, pore and fiber sizes between layers with said porosity in such an arrangement comprising the ratio of pore volume to the total volume of filter media so that the overall average pore size of the majority of pores of combined adjacent successive layers is smaller than that of the average overall pore size of the majority of pores of said independent finest fiber thickness layer calculated by formulas expressed:

$$\frac{1}{M} = \varepsilon_1 \varepsilon_{i+1} \dots \varepsilon_n \left( \sum_{i=1}^n \frac{1}{M_i} \right)$$

and

$$\frac{1}{v} = \varepsilon_1 \varepsilon_{i+1} \dots \varepsilon_n \left( \sum_{i=1}^n \frac{1}{v_i} \right) \quad 6$$

with the porosity "ε" is the ratio of pore volume to the total volume of medium, "Σ" is the summation from "i" = 1 to n, and "M" is the mean flow pore diameter of the filter media layers and "v" is fluid velocity in cubic feet per minute over square feet (cfm/sq. ft.).